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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER FERNANDEZ, KATHERINE L				
ART UNIT		PAPER NUMBER		
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/537,116

**Applicant(s)**

GRINVALD ET AL.

**Examiner**

KATHERINE L. FERNANDEZ

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 March 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 45-56, 58 and 66-81 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 45-56, 58 and 66-81 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 June 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB08)  
Paper No(s)/Mail Date 3/21/08
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

***Claim Objections***

1. Claims 68-69 are objected to because of the following informalities:

Claim 68 recites the limitation "said roughness" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 69 recites the limitation "said roughness" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Appropriate correction is required.

***Claim Rejections - 35 USC § 101***

2. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 45-56, 54-56 and 58 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. In addition to inquiry of whether a claimed method fails within a judicial exception, Supreme Court precedent (Diamond v. Diehr, 450 U.S. 175, 184 (1981); Parker v. Flook, 437 U.S. 584, 588 n.9 (1978); Gottschalk v. Benson, 409 U.S. 63, 70 (1972); Cochrane v. Deener, 94 U.S. 780, 787-88 (1876).) and recent Federal Court decisions, require that a claim drawn to a process must (1) be tied to another statutory class (such as a particular apparatus) or (2) transform underlying subject matter (such as an article or materials) to a different state or thing. If neither of these requirements is met by the claim, the method is not a patent eligible process under 35 U.S.C. 101 and is improperly directed to nonstatutory subject matter. To qualify as a 101 statutory process, the claim should (1) positively recite the other statutory class (the thing or product) to which it is tied, for example by

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identifying the apparatus that accomplishes the method steps or (2) positively recite the subject matter that is being transformed. The limitations (i.e. optically imaging moving erythrocytes, determining from said optical imaging at least one flow characteristic, utilizing said at least one flow characteristic for identifying roughness) are non-statutory because they are not tied to another statutory class (such as a particular apparatus), nor do they positively recite subject matter being transformed.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claim 45-50, 52-53, 66-68, 70-77, 79-81 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grinvald et al. (WO 99/63882) as cited by applicant in view of Zarins et al. ("Carotid bifurcation atherosclerosis: Quantitative Correlation of Plaque Localization with Flow Velocity Profiles and Wall Shear Stress", 1983).

Grinvald et al. disclose a method for vascular analysis of a subject, comprising the steps of: optically imaging moving erythrocytes within at least one optically accessible blood vessel of a subject (pg. 3, last paragraph-pg. 4, top paragraph; pg. 5; pg. 8, 1st-2nd paragraphs); and determining from said optical imaging at least one flow characteristic of said erythrocytes in at least one optically accessible blood vessel (pg. 5; pg. 9, 5th paragraph-pg. 10, 1st paragraph; pg. 12, 3rd paragraph, referring to determining blood flow direction and a rate-of-flow map from data from images). The

blood vessel can be a retinal blood vessel or can be located in tissue of an internal organ (i.e. brain tissue) (pg. 7, last paragraph-pg. 8, first paragraph). The optical imaging comprises acquiring at least two sequential images of erythrocytes in said at least one optically accessible blood vessel (pg. 3, last paragraph-pg. 4, 2nd paragraph; pg. 5, last paragraph). Grinvald et al. further disclose a system for performing the method discussed above, which includes a light source for illuminating at least one optically accessible blood vessel of the subject (pg. 6, 3rd paragraph), an imager for acquiring a plurality of images of moving erythrocytes showing sequential spatial distribution of said moving erythrocytes in said at least one optically (pg. 5), an image discriminator for determining from said plurality of images showing sequential spatial distribution, a flow pattern of erythrocytes along said blood vessel (pg. 5; pg. 9, last paragraph-pg. 10, 2nd paragraph), and a flow analyzer for analyzing said flow pattern to determine at least one flow characteristic of erythrocytes along said at least one optically accessible blood vessel of the subject (pg. 5; pg. 11, 2nd paragraph; pg. 12, 3<sup>rd</sup>-4<sup>th</sup> paragraph). Their system further comprises a wavelength selector (i.e. bandpass filter) configured to configure said imager to acquire said images of said at least one optically accessible blood vessel over a limited wavelength band (pg. 6, last paragraph). The wavelength selector is located in an illuminating pathway between said light source and said at least one optically accessible blood vessel and in an imaging pathway between said at least one optically accessible blood vessel and said imager (pg. 6, last paragraph). Although Grinvald et al. do not specifically disclose that the wavelength band is between 2 and 30 nm, it would have been within the skill of one of ordinary skill

in the art to modify the invention of Grinvald et al. to experimentally adjust the wavelength band to between 2 and 30 nm in order to determine the appropriate wavelength. The light source for illuminating said at least one optically accessible blood vessel of the subject is a pulsed source having a pulse to pulse interval of less than 1 second or between 5 and 200 ms (pg. 5, last paragraph-pg. 6, 3<sup>rd</sup> paragraph). Grinvald et al. further disclose that their system includes a computer and a display monitor for viewing the results of automatic image analysis and permitting interactive image analysis, and a printer for hard copy output of analysis results (pg. 5).

However, they do not specifically disclose that their method includes the step of utilizing said at least one flow characteristic for identifying roughness on an inner wall of said at least one optically accessible blood vessel. Further, they do not specifically disclose that their method includes the step of utilizing said identifying of said roughness on said inner wall of said at least one optically accessible blood vessel in order to determine a level of arteriosclerosis in the subject or that their system includes a wall analyzer for utilizing said at least one flow characteristic for determining at least one property of an inner surface wall of said blood vessel. Zarins et al. disclose a study relating the axial and circumferential distribution of early asymptomatic, nonstenosing, intimal lesions to flow patterns, flow velocity profiles, and shear stresses (pg. 503, left column, 1st paragraph). They disclose that their findings indicate that regions of reduced wall shear stress, flow separation, flow reversal, and departure from axial flow are associated with maximum intimal thickening and atherosclerotic plaque formation and regions where flow is axial and unidirectional, and flow velocities and wall shear

stresses are high, tend to be spared. At the time if the invention, it would have been obvious to one of ordinary skill in the art to modify the invention of Grinvald et al. to include a wall analyzer to perform the step of utilizing at least one flow characteristic (i.e. flow direction, flow rate) for identifying roughness on an inner wall of said at least one optically accessible blood vessel, as Zarins teaches that flow characteristics (i.e. flow direction, flow rate) are indicators of atherosclerotic plaque formation (i.e. roughness on inner wall of blood vessel).

5. Claim 51 and 69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grinvald et al. in view of Zarins et al. as applied to claim 45 above, and further in view of Wong et al. ("Retinal microvascular abnormalities and incident stroke: the Atherosclerosis Risk in Communities Study", October 2001) as cited by applicant.

As discussed above, the combined references of Grinvald et al. in view of Zarins et al. meet the limitations of claims 45 and 68. However, they do not specifically disclose that their method further comprises the step of utilizing said identifying of said roughness on said inner wall of said at least one optically accessible blood vessel in order to determine a condition of another blood vessel of the subject. Wong et al. disclose a study investigating the relation between retinal microvascular abnormalities to incident stroke (pg. 1134, left column, Summary:Background). They conclude that retinal microvascular lesions (i.e. roughness on wall of blood vessel) can be markers of general vascular pathology (such as atherosclerosis, which is a form of arteriosclerosis) rather than specific microvascular pathology (pg. 1139, left column, 1<sup>st</sup> paragraph). At the time of the invention, it would have been obvious to one of ordinary skill in the art to

have included the above limitations to the method of Grinvald et al. in view of Zarins et al., as taught by Wong et al., in order to provide a non-invasive way to be able to determine the risk of arteriosclerosis in an individual (pg. 1139, left column, 1<sup>st</sup> paragraph).

6. Claims 54-56 and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grinvald et al. in view of Zarins et al., and further in view of Taylor '02 ("In Vivo Quantification of Blood Flow and Wall Shear Stress in the Human Abdominal Aorta During Lower Limb Exercise", March 2002).

As discussed above, the combined references of Grinvald et al. and Zarins et al. meet most of the limitations of claim 54 (i.e. optically imaging moving erythrocytes once and then again, determining from said optical imaging at least one erythrocytic flow characteristic, and utilizing differences in said at least one flow characteristic to determine a roughness index of an inner wall of said at least one optically accessible blood vessel). However, they do not specifically disclose that optically imaging the moving erythrocytes the first time is performed with subject having a first blood pressure, said first pressure being subject to change to a second blood pressure, optically imaging the moving erythrocytes within the blood vessel again when said first blood pressure of said subject has changed to said second blood pressure, nor do they disclose that the change from said first blood pressure to said second blood pressure is caused by at least one of exercise and drugs administered to the subject. They also do not disclose that the change of said first blood pressure to said second blood pressure is a result of the subject's heartbeat. Further, they do not disclose that their method



includes the limitations of instant claims 56 and 58, which disclose that the first blood pressure corresponds to a first point in a cardiac cycle of the subject wherein said second blood pressure corresponds to a second point in the cardiac cycle of the subject, and wherein the optical imaging steps comprise optically imaging moving erythrocytes within said at least one optically accessible blood vessel when the subject's cardiac cycle is respectively at said first and second points in the subject's cardiac cycle, or that the optical imaging steps comprise detecting a parameter of the subject selected from the group consisting of the subject's cardiac cycle and blood pressure of the subject, and optically imaging the moving erythrocytes in response to the selected parameter.

Taylor '02 disclose a study that measures, in vivo, the spatial distribution of blood flow velocities in the abdominal aorta of human subjects during upright rest and light exercise conditions (pg. 403, left column, 3<sup>rd</sup> paragraph). They disclose that data was collected at rest and during steady-state exercise conditions within the range of light exercises (i.e. data was collected at two different heart rates, which cause a change in blood pressure; also scans were synchronized with the subject's heart beat) (pg. 403, right column, 2<sup>nd</sup> paragraph). They further disclose that the image acquisitions were gated to the cardiac cycle using a plethysmograph, and that the data was retrospectively reconstructed at 16 discrete time points within the cardiac cycle (pg. 403, right column, 3<sup>rd</sup> paragraph). Further, the subjects monitored their own heart rate, which was displayed in real-time on a pulse monitor (pg. 403, right column, 2<sup>nd</sup> paragraph). At the time of the invention, it would have been obvious to one of ordinary

skill in the art to have the optical imaging steps in the method of Grinvald et al. in view of Zarins et al. be performed at different blood pressure readings, wherein the change in pressure readings is a result of exercise performed by the subject and to further include the limitations of claims 56 and 58, as taught by Taylor '02, in order to determine the effect of activities that change blood pressure (such as exercise) have on flow characteristics (pg. 403, left column, 2<sup>nd</sup>-3<sup>rd</sup> paragraphs).

7. Claim 78 is rejected under 35 U.S.C. 103(a) as being unpatentable over Grinvald et al. in view of Zarins et al. as applied to claim 66 above, and further in view of Flower '94 (US Patent No. 5,279,298).

As discussed above, the above combined references meet the limitations of claim 66. Further, they disclose that the imager is configured to acquire images at predetermined intervals (pg. 5, last paragraph-pg. 6, 2<sup>nd</sup> paragraph). However, they do not specifically disclose that the light source for illuminating said at least one optically accessible blood vessel of the subject is a continuous source. Flower '94 discloses a method and apparatus to detect and treat neovascular membranes in the ocular vasculature of the fundus of the eye (column 1, lines 8-10). They disclose the use of a continuous light source and that the imager acquires the images at predetermined intervals (column 5, lines 34-52, referring to the computer recording successive images or frames of the fundus of the eye with the passage of time). At the time of the invention, it would have been obvious to one of ordinary skill in the art to include the above limitations in the system of Grinvald et al. in view of Zarins et al., as their

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invention requires an illumination source and Flower et al. teach the successful use of a continuous illumination source when imaging a vessel.

***Response to Arguments***

8. Applicant's arguments with respect to claims 45-81 have been considered but are moot in view of the new ground(s) of rejection.

***Conclusion***

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KATHERINE L. FERNANDEZ whose telephone number is (571)272-1957. The examiner can normally be reached on 8:30-5, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Casler can be reached on (571) 272-4956. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Eric F Winakur/  
Primary Examiner, Art Unit 3768